



Original Research Article

PHYTOCHEMICALS, AND PROXIMATE ANALYSES OF DRIED BARK AQUEOUS EXTRACT OF *SWIETEINIA MAHAGONI* (L) JACQ, HARVESTED FROM OBUDU, CROSS RIVER STATE, NIGERIA

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ABSTRACT

Plants play an important role in phytomedicine as sources of phytochemicals. *Swietenia mahagoni* is used in folkloric medicine for treating diarrhea, skin infections, tumors, inflammations, and diabetes. This led to the determination of selected phytochemicals and proximate contents from the dried bark aqueous extract of *Swietenia mahagoni*. The constituents were determined by standard analytical methods. Triterpenoids, lignans, thiocyanates, flavonols, saponins, and alkaloids, were detected. The results revealed triterpenoids (3.47 ± 0.01 %), flavonols (3.42 ± 0.47 %) saponins (3.42 ± 0.31 %), lignans (1.09 ± 0.04 %), thiocyanate (0.84 ± 0.03 %), and lectin was not detected. The antinutrients revealed phytates (1.15 ± 0.3 mg/100 g), oxalates (0.24 ± 0.1 mg/100 g) and cardiac glycoside (0.17 ± 0.2 mg/100 g). Proximate results revealed high moisture (55.67 ± 4.04 %), carbohydrate (25.64 ± 4.37 %), (8.58 ± 0.82 %), crude fiber (6.49 ± 6.37 %), proteins (1.86 ± 0.21 %), and crude fat (1.77 ± 0.26 %) contents. The mineral contents revealed sodium (23.21 ± 0.04 mg/l) and potassium (13.13 ± 0.06 mg/l) concentrations. Vitamin A (3.23 ± 0.21 mg/l), vitamin C (2.25 ± 0.10 mg/l), vitamin B1 (0.62 ± 0.10 mg/l), B2 (0.43 ± 0.10 mg/l) and B3 (0.15 ± 0.03 mg/l). However, vitamin K was below the detectable limit (bdl). Overall, this study demonstrates that the dried bark aqueous *Swietenia mahagoni* from Obudu, Cross River, is rich in secondary metabolites, proximates, vitamins, and minerals. The pharmacological screening of the bioactive constituents needs to be evaluated for possible health benefits.

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INTRODUCTION

Plants play an important role in phytomedicine as the sources of phytochemicals, which are employed for herbal treatment and in meals with healing potential. As a result, the field of drug discovery requires a thorough screening of plants for bioactive constituents of medicinal importance. *Swietenia mahagoni* (L.) Jacq belongs to the genus of *Chineberry* and

the family of *Meliaceae*. It exists as a 30 m height tree with, a 1 m diameter buttressing base and a large spherical crown with heavy branches and dense shade [1]. The leaves have been used traditionally for the management of diarrhoea, malaria, hypertension, astringent, and diabetes, while the fruit has been used as an anti-hyperglycemic drug. The seed oil serves as an alternative therapeutic ointment for itches and

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skin cuts to enhance healing. The bark is used as an energizer and stimulant for appetite. It is also used for the treatment of toothache, tuberculosis, diarrhea, anemia, fever, and dysentery [2]. However, there are limited reports on its phytochemical and nutritional properties.

Swietenia mahagoni (L.) Jacq has been reported to possess anti-inflammatory, anti-HIV, antibacterial, antimicrobial, anti-fungal, antioxidant, anti-ulcer, inhibitor of platelet aggregation, antipyretic, and analgesic properties [3]. Phytoestrogens are plant-based biological molecules generated from plants and may differ from one another depending on the species, section, geographical region, harvest time, and processing method of the plant. They possess estrogenic properties on the central nervous system, helps in female genital tract growth, and are found in over 300 plant species and plant products, including some utilized in animal diet [4]. They act in the same way by binding to estrogen receptors. Phytoestrogens are majorly classified into three which are; Coumestans, Isoflavones, and Lignans [5].

Lignans are widely distributed in the plants' parts such as roots, rhizomes, stems, and bark, with various pharmacological properties such as antitumor, antioxidant, antibacterial, immunosuppressive, and antiarrhythmic properties [6].

Antinutrients are naturally present in various plants and include phytates, oxalates, tannins, cyanides, and cardiac glycosides, possessing both beneficial and harmful effects on the body. The antinutrients also served as a defense mechanism for plants, deterring herbivores and pests from destroying them [7]. Some antinutrients, such as certain polyphenols found in tannins, exhibit anti-inflammatory and antioxidant properties, making them valuable in human diets [8]. Antinutrients can offer advantages in sustainable agriculture by reducing the need for chemical pesticides and promoting a balanced ecosystem. However, the presence of antinutrients also comes with disadvantages [9]. Phytates and oxalates can hinder the uptake of minerals in the digestive tract, potentially leading to nutrient deficiencies. High levels of certain antinutrients, such as cyanides and cardiac glycosides, can pose serious health risks, causing toxicity and adverse effects in humans and animals [10]. This study focuses on qualitative and quantitative analyses of various phytochemicals, anti-nutrients, proximate, vitamin, and minerals contents in aqueous dried bark extract of *Swietenia mahagoni* collected from Obudu, Cross River State.

MATERIALS AND METHODS

Equipment

UV spectrophotometer Model: SP-300 Optima, Japan), electronic weighing balance (RS Stock No: 700-7092, PCB 1000-1/RS, China), Beaker (10-1000ml), and water bath (model 286 43l 120V, Japan) were obtained from the Department of Chemistry University of Calabar

Chemicals

The chemicals used in the course of the research were all of the analytical standards and were purchased from Zayo Sigma Chemical Limited Lagos, Nigeria.

Plant material Collection and Preparation

The aqueous dried bark of *Swietenia mahagoni* was harvested from Allege, Obudu, Cross River State, Nigeria. The plant bark was identified and authenticated by Pastor Franck Akposeye of the Department of Botany, University Calabar, Calabar, Nigeria, with Voucher Number BOT/SM/2023/002. The materials collected were shade-dried for three weeks and pulverized using a pestle and mortar to crush into powder.

Half a gram of the crushed bark of the plant sample was measured with an electronic weighing balance (FA1004 N) into three different crucibles. A Muffle furnace (TMAX-1750DD) was used to ash the sample for 3 hours. The ashed sample contains thirty milliliters of aqua regia (3:1 of hydrochloric acid and nitric acid) and was subjected to 15 minutes of centrifugation. Quantitatively, the digested samples were transferred into 50 mL volumetric flasks and made up to a mark of 100 ml.

Qualitative Phytochemicals Analysis of *S. mahagoni*

The obtained *S. mahagoni* extract was subjected to phytochemical screening to establish its phytochemical composition. The following identification methods were used to screen phytochemical components.

Proximate and minerals Analysis

The AOAC (Association of Official Analytical Chemists) was used for protein, ash, moisture, crude fiber, fats, carbohydrates, sodium, manganese, calcium, zinc, potassium, magnesium, iron, and copper in mahogany.

Identification of Triterpenoids

The identification of triterpenoids was carried out following the Salkowski method [11].

Identification of Thiocyanates by Spot Test

A total of 5ml of the sample was measured into test-tube, 1ml of 0.5 KSCN and 1ml of acetic acid ($\text{HC}_2\text{H}_3\text{O}_2$) was added, followed by 2 drops of 0.1ml of $\text{Fe}(\text{NO}_3)_3$. The presence of thiocyanates resulted in a dark red color.

Identification of Lignans by Molisch's Test

A total of 2ml of the extract was measured into the test tube and a few drops of Molisch reagent were added which resulted in violet color formation indicating the presence of lignans.

Quantitative Phytochemical and Antinutrients Analyses of *S. mahagoni*.

The following methods were used for the determination of the amount of phytochemical composition.

Determination of Triterpenoids

The quantitative determination of triterpenoids was done following the procedures described by [12]. The yield (%) calculated using equation 1.

$$\% \text{ of triterpenoids} = \frac{W_i - W_f}{W} \times 100 \dots\dots \text{Equation 1}$$

W = sample weight, W_i = initial weight of beaker, W_f = ignited weight of beaker and residue.

Determination of Thiocyanate

This was carried out following the method described by [13]

Determination of Lignans [6]

The analysis was performed on an Agilent Zorbax Eclipse Plus C18 column (4.6mm×150.5um), using a binary gradient system of water and methanol, with a UV-visible spectrophotometer with absorbance of 230 nm.

Determination of Lectins

Weighed 20 grams of the sample was soaked in 100 ml buffered saline (0.8% NaCl; 1:8 w/v), at room temperature for 12 hours. Eight-mesh grid was used to filter the diffuse homogenate after 24 hours, and the filtrate was subjected to centrifugation at 6000 rpm for 30 minutes. The supernatant was saturated with ammonium sulfate at a concentration of 20-8%. Then, the precipitate was centrifuged for 30 minutes at 8000 rpm, mixed in 0.02 PBS, pH 7.2, and measured with a UV-visible spectrophotometer at 280 nm. Furthermore, the titrate was centrifuged for 30 minutes at 6000 rpm again, and the supernatant was saturated with ammonium sulfate at a concentration of 20-8%. The precipitate obtained was centrifuged for 30 minutes at 8000 rpm, mixed in 0.02 PBS, pH 7.2, and measured at 280 nm with a UV-visible spectrophotometer.

Determination of Tannins

Tannin was determined according to the method described by [13], the data was calculated using Equation 2.

$$\text{Tannin (\%)} = \frac{S \times A \times G \times D \times F}{W \times S} \times 1000 \dots\dots \text{Equation 2}$$

S A = sample absorbance, A G = average gradient, D F = dilution factor, W S = dilution factor

Determination of Phenols Content

The phenolic content was determined according to the method described by [14].

Total Alkaloids Determination

The alkaloid content was determined according to the method described by [15] and was calculated using Equation 3.

$$\text{Alkaloid} = \frac{\text{residue alkaloids weight}}{100/\text{volume}} \dots\dots \text{Equation 3}$$

Flavonoids determination

Flavonoid content was determined according to the method described by [16].

Determination of Oxalates

Oxalate content was determined according to the method described by [17].

Determination of Phytates

Phytate content was determined according to the method described by [18], and was calculated using the Equation 4.

$$\% \text{ Phytate} = 100 \times \frac{A_u}{A_s} \times C \times \frac{V_c}{V_a} \dots\dots \text{Equation 4}$$

where: w = weight of sample,

A_u = Absorbance of sample,

A_s = Absorbance of standard phytate solution

C = Concentration of Standard phytate (mg/ml),

V_c = Total extract volume,

V_a = Volume of extract

Determination of Tannins

This was carried out following the procedures described by [19].

Determination of Cyanide

Cyanide content was determined according to the method described by [20].

Determination of Cardiac glycosides

Cardiac glycoside content was determined according to the method described by [12] and was calculated using Equation 5.

$$\text{Glycosides} \frac{\text{mg}}{100\text{g}} = \frac{\text{titer values (ml)} \times 1.08 \text{ (g)} \times \text{extract vol (ml)} \times 100}{\text{aliquot vol. (ml)} \times \text{weight of sample (g)}} \dots\dots \text{Equation 5.}$$

RESULTS AND DISCUSSION

S. mahagoni has been used traditionally for the management of different ailments. The leaves and seeds were also reported to be rich in phytonutrients and proximate contents [2, 4]. Table 1 shows all the selected phytochemicals with triterpenoids (3.47 ± 0.1 mg/100g) present in high concentration compared to other phytochemicals. Triterpenoids are among the plant's secondary metabolites and vary structurally depending on the class of plant in which they are produced. Based on their backbone structure, triterpenoids are classified as hemiterpenoids, monoterpenoids, homoterpenoids, etc., and this is based on the number of atoms they possess [21]. It has been reported that triterpenoids have anti-inflammatory, antioxidant, antitumor, antibacterial, and as well as antiparasitic properties. They also protect against oxidative damage [21].

The high content of triterpenoids in the aqueous dried bark extract of the *S. mahagoni* plant is a pointer to its possible application in phytomedicine for the management of ailments such as inflammation, tumors, and bacterial infections.

Thiocyanates are a common group of phytochemicals under a larger class called goitrogens. It has been reported to

possess anticancer, antioxidant, and anti-inflammatory properties. So, the presence of thiocyanates in the dried bark of *S. mahagoni* also indicates its potential effect to possibly

Table 1: The phytochemical constituents of *Swietenia mahagoni* dried bark aqueous extract after the qualitative and quantitative analyses

Phytochemical	Qualitative	Quantitative (mg/100g)
Terpenoids (triterpenoids)	+	3.47 ± 0.014
Lignans	+	1.09 ± 0.042
Thiocyanates	+	0.84 ± 0.028
Lectins	ND	0.00
Phenols	+	2.64 ± 0.021
Flavonoids (flavonols)	+	3.01 ± 0.022
Alkaloids (quinine)	+	0.79 ± 0.10
Saponins	+	3.42 ± 0.3

Keys: +: Present, ND: Not Detected

Table 2: Antinutrient contents of dried bark aqueous extract of *Swietenia mahagoni*

Compounds	Indications	Amount (mg/100g)
Oxalates	+	0.24 ± 0.1
Phytates	+	1.15 ± 0.3
Cardiac glycosides	+	0.17 ± 0.2
Tannins	+	1.23 ± 0.3
Cyanides	-	ND

Hint: (+) = Present (-) = Negative, ND = Not detected

Table 3: Proximate compositions of dried bark aqueous extract of *Swietenia mahagoni*

Proximate compositions	Mean ± SEM (%)
Moisture content	55.67 ± 4.04
Ash	55.67 ± 4.04
Fats	1.77 ± 0.26
Protein	1.86 ± 0.21
Carbohydrate	25.64 ± 4.37
Fiber	6.49 ± 0.37

The results were presented as percentage of mean ± SEM (standard error of the mean)

Table 4: Mineral contents of dried bark aqueous extract of *Swietenia mahagoni*

Minerals	mg/l
Magnesium	3.37 ± 0.02
Calcium	4.33 ± 0.30
Sodium	23.21 ± 0.04
Zinc	0.28 ± 0.01
Iron (Fe)	1.42 ± 0.15
Potassium (K)	13.13 ± 0.0
Manganese (Mn)	BDL
Copper (Cu)	BDL

The results presented as mean ± SEM, BDL= Below Detection Limit.

Table 5: Vitamin compositions of dried-bark aqueous extract of *Swietenia mahagoni*

Vitamins	Concentration (mg/l)
A	3.23 ± 0.21
B1	0.62 ± 0.10
B2	0.43 ± 0.10
B3	0.15 ± 0.03
C	2.25 ± 0.10
K	BDL

Result presented as mean ± SEM

modulate inflammatory action and reduce oxidative stress [22]. There was no recent literature on thiocyanates content in mahogany plants.

Lignans are found in plant phytochemicals and possess pharmacological properties such as antiarrhythmic, immunosuppressive, antitumor, and antioxidant properties. Therefore, the presence of lignans in *S. mahagoni* extract suggests its potential effect in ameliorating hyperglycemia, and as an immunosuppressant [6]. There was no current literature on the lignans content in mahogany.

Tannins act as a chemical defense system in plants against herbivores, pests, and pathogens. They can deter feeding by making plant tissues unpalatable and interfering with the digestion of nutrients. Studies revealed that tannins could help in maintaining a healthy heart by promoting healthy cholesterol levels and improving blood vessel function. Tannins can have astringent effects and have been used traditionally to alleviate diarrhea and other gastrointestinal issues [23]. According to Rahman and colleagues, a high amount of tannin ($2.00.98 \pm 0.59$ mg/100g) was observed in the methanol seed extract of *Swietenia mahagoni* compared to (1.23 ± 0.3 mg/100g) recorded in this study. They evaluated the seed of *Swietenia mahagoni* and found the presence of tannins and oxalates and suggested that they could promote wound healing [22].

The mahogany leaves contain a sizeable amount of total phenolic, tannin, and flavonoid contents. The leaves have anti-diabetic, anti-bacterial, anti-oxidant, anti-microbial, anti-fungal, antidiarrhoeal, anti-inflammatory, and anti-malarial [24]. The bark contains tannin; limonoids saponins, anthraquinones, alkaloids, phenols, triterpenoids, cardiac glycosides, and flavonoids. *Swietenia mahagoni* possesses anthelmintic, cytotoxic, astringent, antimicrobial, antipyretic, abortifacient, depurative, hepatoprotective properties, anticoagulant, antioxidant, gastroprotective, antidiabetic, and antiprotozoal potential [23].

The reason for the absence of lectins in the dried bark aqueous extract is not known yet. Though lectins have not been recorded by other researchers who have carried out analyses on other parts of *S. mahagoni*. In encouraging a balanced ecology and lessening the need for chemical pesticides, antinutrients can be beneficial in sustainable agriculture [9]. However, there are drawbacks to the presence of antinutrients in our foods. Substances such as phytates and oxalates can impede the absorption of vital

minerals, which may result in dietary deficiencies [8]. Elevated concentrations of specific antinutrients like cardiac glycosides and cyanides, can be extremely harmful to human and animal health [6]. Table 2, shows antinutrient contents of aqueous dried bark extract of *Swietenia mahagoni* with phytate present at (1.15 ± 0.3 mg/100 g), oxalate (0.24 ± 0.1 mg/100 g) and cardiac glycoside at (0.17 ± 0.3 mg/100 g) concentrations which were high compared to a report by [10]. Likewise, our findings are in corroborate the report in a study by [25], where they recorded the presence of phenols and oxalates in the leaves of *Swietenia mahagoni* and also demonstrated further the antidiabetic potential of the plant. In another research, it was reported that active antinutrient compounds as well as phytochemical constituents were present in *Swietenia mahagoni* [18].

Oxalate was present at (0.24 ± 0.1 mg/100 g) concentration as shown in Table 2. It can form insoluble crystals in the presence of minerals like calcium, resulting in kidney stones in susceptible individuals [26]. There was (1.15 ± 0.3 mg/100 g) phytate concentration present in the dried bark aqueous extract of *Swietenia mahagoni* as presented in Table 2. It was high compared to Igbang *et al.*, report of phytates concentration in honey sample. They are naturally occurring compounds in plant-based foods, like legumes, grains, nuts, and seeds [8]. Phytates serve primarily in plants to store phosphorus, helping regulate energy and mineral metabolism. However, they possess the ability to chelate or bind to essential minerals like zinc, calcium, magnesium, and iron, reducing their bioavailability within the digestive tract [29]. This property has led to concerns about the potential impact of phytates on human health, particularly in diets that rely heavily on plant-based foods [27]. High phytates intake has been associated with mineral deficiencies, especially in populations with limited dietary diversity or poor mineral absorption [22]. Nevertheless, phytates also exhibit certain health benefits, such as antioxidant and anticancer properties, and may contribute to glucose regulation and insulin sensitivity [20]. Various traditional food preparation methods, such as soaking, fermenting, and sprouting, can help reduce phytate content and enhance mineral absorption [28].

The proximate analyses in Table 3 above, indicated the compositions of ash, crude fats, moisture, crude fiber, protein, and carbohydrate of dried bark aqueous extract of *Swietenia mahagoni*. The results showed a moisture content of ($55.67 \pm 4.04\%$). This may be due to the regular rainfall area.

The moisture in the sample is a measure of its water activity and it is used as a measure of stability to microbial contamination.

The Ash content was $(8.58 \pm 0.82\%)$. The ash content indicates inorganic residue after burning organic matter. The ash content revealed that the bark is abundant in minerals like Fe, Mg, Na, Ca, and so on as presented in Table 4.

The crude fats content was $(1.77 \pm 0.26\%)$. The fat content appeared to be small which may help reduce the rancidity effect when stored for a longer period. Fats are a subclass of lipid biomolecules and help to maintain the source of biomolecules required by the body. The crude fiber of the dried bark of *Swietenia mahagoni* falls within the range of $(6.49 \pm 0.37\%)$ similar to the value reported [29] on some medicinal plants such as *minosapudica*. The high crude fiber composition of the dried bark aqueous extract of *S. mahagoni* could help reduce the occurrence of diseases such as diabetes, coronary heart disease, colon cancer, and other digestive disorders.

The seed oil indicates unsaturated fatty acids, neutral lipids, and tri-acyl-glycerol in the proportions of 87.0 and 89.4%. Gas-liquid chromatographic analysis showed the presence of fatty acids from series C16:0 to C20:0 in *Swietenia mahagoni* seed oils representing 30.1% linoleic acid. The major energy-producing nutrients, the seed samples contained large amounts of lipids (57.9%), protein (13.0%), and potentially useful amounts of other nutrients [31].

The protein content of *Swietenia mahagoni* was $(1.86 \pm 0.21\%)$ which was relatively lower than the crude fiber content.

The carbohydrate content of $(25.64 \pm 4.37\%)$ was high compared to those of *Cajanus cajan* as reported by [28]. Carbohydrate content in diet caloric can provide energy needed for daily activity in the body. If 1 g of carbohydrate provides 8.37 kcal, it means 100 grams of dried bark could give 337.32 424.62, kcal of energy respectively, plant rich in carbohydrates and low in protein ($< 20\%$) are usually considered as good energy sources. This indicates that the carbohydrate content in *Swietenia mahagoni* is sufficient to provide the energy required by the body system if the extract is used medicinally.

Table 4 shows the mineral contents of dried bark aqueous extract of *Swietenia mahagoni*. Magnesium was present at (2.21 mg/l) concentration, suggesting the presence of magnesium ions in the dried bark of *S. mahagoni*. This information can be relevant for various purposes, such as understanding the nutritional content of the bark or assessing the plant's role in nutrient cycling. Further analysis and comparison with other elements or plant species could provide more insights into the ecological or agricultural significance of magnesium in *Swietenia mahagoni*. Magnesium is obtained from vegetables, vegetables, hard water, green leafy, soybeans, nuts, whole grains, and so on. It helps in maintaining integrity and bone growth, as well as in the regulation of the cardiac cycle including muscles and nerve functions. Magnesium deficiency is associated with

neuromuscular hypomagnesemia. When in excess, it causes symptoms like respiratory failure, cardiac disturbances, and hypotension [30].

Calcium concentration was (1.73 mg/l) in the aqueous dried bark extract of *Swietenia mahagoni* as shown in Table 4. Calcium is an essential element for plant growth and development, playing crucial roles in cell wall structure and stability. Understanding the specific levels of calcium in the bark of *Swietenia mahagoni* can contribute to broader research in plant physiology, nutrient cycling, or potential applications in areas like agroforestry. It also provides valuable information for assessing the overall nutritional composition of the plant. Cells require an adequate amount of calcium to perform various functions [30]. Teeth and bones are rich in calcium. Calcium is involved in nerve function, contraction of muscles, and clotting of blood. Parathyroid and calcitonin hormones play a key role in maintaining calcium balance in the blood. Daily, 1 g of calcium is recommended. Vitamin D helps in calcium uptake in the body. Lack of this vitamin could result in osteoporosis, osteomalacia, and rickets. The excess amount of calcium in the blood can result in the development of kidney [6].

Sodium: A sodium concentration was (7.71 mg/l) in the aqueous dried bark of *Swietenia mahagoni* as shown in Table 4, which revealed the presence of sodium ions in the plant material. Sodium is not typically considered an essential nutrient for most plants, its presence may have ecological or environmental implications. Kidneys are the main regulators of body sodium and normally 98% of the body loss of sodium occurs in urine. An elevated level of sodium in the blood defines hypernatremia and is characterized by seizures, edema, neuromuscular excitability, irritability, weakness, and lethargy.

Zinc: The quantitative composition of zinc in the dried bark of *Swietenia mahagoni* was (4.04 mg/l). Zinc is an essential trace element required by living organisms, including plants. It plays crucial roles in various physiological processes, such as enzyme function, DNA synthesis, and growth regulation. However, it's important to note that the concentration of zinc in different plant species can vary significantly. Zinc is a constituent of metalloenzymes, and also helps in fertility, cell proliferation, and growth as well as in sexual maturity. It improves immunity, appetite, and taste. Zinc deficiency is rare and can be seen in patients with kidney diseases and alcoholic patients. Retarded growth is usually common in children with zinc deficiency. Overconsumption of zinc presents symptoms like decreased immune function and gastrointestinal diseases. The presence of zinc in the bark of *Swietenia mahagoni* suggests that this tree species can accumulate or uptake zinc from the surrounding environment.

This indicates that the dried bark of mahogany is a good source of both macro and micro elements. These macro and microelements are essential to the body for the normal metabolic and proper well-being of humans. Therefore, from the above results, we can deduce that the aqueous dried bark of mahogany contains a high amount of potassium and a little

iron. We can also state that some elements were lacking and these might be due to soil factors or weather conditions as reported by [29]. The contents of potassium (13.13 ± 0.9 mg/l) and Na ($23.0.3$ mg/l) in dried bark *S. mahagoni* (L.) Jacq were high compared to those reported by [30] in the honey sample to (6.006 ± 0.9 mg/l).

Microelements such as Mg, and Fe, were (3.37 ± 0.02 mg/l) compared to those reported in previous studies to be (1.94 ± 0.09 mg/l) and (0.19 ± 0.02 mg/l), suggesting high magnesium and iron content in mahogany compared to honey samples [30]. These elements play critical roles in animal and human physiological functioning. The results were in agreement with the results given by [30], where they reported the nutritional composition of *Barbie de maize*. The high amount of K and Ca helps in maintaining blood pressure, and bone health, regulating serum levels of harmful lipids, and preventing obesity and diabetes [30]. The vitamin contents in dried bark aqueous mahogany extract were as presented in Table 5.

CONCLUSION

This study revealed that the dried bark aqueous extract of *Swietenia mahagoni* contains some phytochemicals with high medicinal potential and possesses the nutritional quality that can be used as a supplement for human needs. The pharmacological effects of the reported phytochemicals have various therapeutic applications in cancer, hypertension, diabetes, microbial infections, and other oxidative degenerative diseases. The nutritive factor and proximate constituents have useful applications in pharmaceutical, agriculture, and nutritional medicine research. These findings are in line with previous research on phytochemicals and antinutritional factors in different plant species, emphasizing the variability in phytochemical and antinutrient contents as affected by their geographical locations. This research provides valuable insights into the antinutrient profile of *Swietenia mahagoni*, emphasizing its potential for broader utilization in agriculture, nutrition, and medicine. While antinutrients can have adverse effects, their role in promoting sustainable agriculture and balanced ecosystems should not be overlooked. The presence of medically and pharmacologically important agents in dried bark aqueous extract *Swietenia mahagoni* further revealed its potential retention when it is dried for storage or export to areas of demand. Further pharmacological screening of the phytochemicals present in *Swietenia mahagoni* would be of great importance.

CONFLICT OF INTEREST

All the authors declare no conflict of interest.

AUTHORS' CONTRIBUTION

IJO - Project administrator, bench work, writing original draft, EEU - bench work, OFI - bench work, OVO - bench work, CGO - Bench work, writing original draft, OAA - harvested

sample, bench work, writing original draft, ORB - Bench work, writing original draft, FLA - bench work, writing original draft, OBB - Bench work, writing original draft, MSN - Bench work, writing original draft.

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REFERENCES

1. Sukardimann ME. The recent use of *Swietenia mahagoni* (L.) Jacq as antidiabetes type 2 phytomedicine: a systemic review. *Heliyon Journal*, 6, 2020: e03536.
2. Naveen Y, Urooji A, Rupini G, Ahmed F. Pharmaceutical effect and active phytoconstituent of swietenia Mahagoni; Review. *Journals of Medical Research*, 2, 2014: 86-39.
3. Umesh BT, Satish BK, Shweta P, Devender S, Swati NL. Phytochemistry and pharmacological activities of *Swietenia macrophylla* king (Meliaceae). *Scholar Academic Journal of Pharmacy*, 11(1), 2022: 6-12.
4. Surendra D, Neha K, Sonal S, Hansa K. Nutritional, antioxidant and antinutritional aspects of Superfood: Quinoa. *Food and Scientific Reports*, 3(4), 2022: 30.
5. Charkraborty B, Mukerjee N, Maitra S, Zehravi M, Mukherjee D, Gosh A, Massoud EE, Rahman MH. Therapeutic potential of different natural products for the treatment of Alzheimer diseases, *Oxidative Medicine and Cell Longevity*, 2022: 6873874. DOI:10.1155/2022/6873874.
6. Ruikun D, Qinghua C, Miaomiao L, Lijun R. Lignan and their derivatives from plants as antiviral: *Journal of Biomolecules*, 25(1), 2020: 183.
7. Syame SM, Mohamed SM, Elgaby EA, Yousof AA, Asmaa SM. Chemical characterization, antimicrobial, antioxidant, and cytotoxic potentials of *Swietenia mahagoni*. *AMB Express*, 12, 2022:17-26.DOI:10.1186/s13568-022-01406-w.
8. Popova A, Mihaylova D. Antinutrient in plant-based food: A review. *Biotechnology Journal*, 13(1), 2019: 3-7.
9. Badri S, Pavitra P, Sameena D, Anitha G, Asifa SK, Mahesh K, Pushpalatha E, A review on medicinal plants containing glycosides. *UPI Journal of Pharmaceutical Medical and Health Sciences*, 6(3), 2023:8-15.
10. Igbang OJ, Abang O, Enej. Selected antinutrients and proximate compositions, of honey (*Apis mellifera*) sample collected from biase, southern senatorial district of Cross river State, Nigeria.

- Journal of Biochemistry and Pharmacology, 7, 2018:1-5.DOI:10.4172/2167-0501.1000261.
11. Sarkowski T. Determination of trierpanoids from plants and foods. *Journal of Agriculture and Food Chemistry*, 1, 2003: 175.
 12. Harbone JB. *Phytochemical Methods A Guide to Modern Techniques of Plant Analysis*; 3rd Ed, 60, Chapman & Hall London Publisher, London, 1973.
 13. Michajlovskij N, Langer P. Studies On Relations Between Thiocyanates Formation And Goitrogenic Properties of Food. *Hoppe Seylers Z Physiological Chemistry*, 312(1-3), 1985: 3-6.
 14. Folin-Ciocalteu Method for Estimation of (Poly) Phenol Content in Food. *Journal of Agricultural and Food Chemistry*, 2023:71-46.
 15. Evans WT. *Pharmacognosy* 15th Ed, volume 1, Saunders Publisher, London, London, 2002. 42-44.
 16. Harbone JB. *Phytochemical Methods A Guide to Modern Techniques of Plant Analysis*. 3rd Ed. 60, Chapman & Hall London Publisher, London, 1973.
 17. Smruti S. Role of medicinal plant in human health perspective. *Acta Scientific Agriculture*, 5(6), 2021: 65-68.
 18. Naveen YP, Rupini GD, Ahmed F, Urooj A. Pharmacological effects and active phytoconstituents of *Swietenia mahagoni*: a review. *Journal of Integrative Medicine*, 12(2), 2014: 86-93.
 19. Hönöw R, Hesse A. Comparison of extraction methods for the determination of soluble and total oxalate in foods by HPLC-enzyme-reactor. *Food Chemistry*, 78(4), 2002: 511-521.
 20. Institute of Chemistry. *Analytical manual*, Revised Ed. University of Philipines, Diliman, Quezon City, 2007:53.
 21. Ahanger M, Tyagi S, Kadambot H, Parvaiz A. Understanding Drought Tolerance In Plants: *Physiologia Plantarum*, 172(2), 2021: 286-288.
 22. Jawi IM, Mahendra AN, Subawa AA, Yasa IW, Gunawan IWG. Comparison of Antihypertensive and Antioxidative Effect of Mahogany (*Swietenia Mahagoni* (L.) Jacq.) Seed Extract and Purple Sweet Potato (*Ipomoea Batatas*) Tuber Extract on Rodent Model of Hypertension. *Biomedical and Pharmacological Journal*. 10(2), 2017: 577-582.
 23. Patel D, Prasad S, Kumar R, Hemalatha S. An overview on antidiabetic medicinal plants having insulin mimetic property *Asian Pacific Journal of Tropical Biomedicine*, 2(4), 2022:320–330.
 24. Alma SB., *Medicinal Plants Utilization Healers and Their Patients in Bicol Region, Philippine*. Bicol University R&D Journal, 25(2), 2022: 21-35.
 25. Ervina MS. The recent uses of *Swietenia mahagoni* (L.) Jacq. As antidiabetes types 2 phytomedicine: A systemic review. *Heliyon*, 6(3), 2020: e03536.
 26. Xie J, Li J, Jie Y, Xie D, Yang D, Shi H, Zhong Y. Comparative transcriptomics of stem bark reveale genes associated with bast fiber development in *Boehmeria nivea* L. gaud (ramie). *Biomed Central (BMC) Genomics*, 21, 2020: 1-17.
 27. Azwanida NN. A review on the extraction methods use in medicinal plants, principle, strength and limitation. *Medicinal Aromatic Plants*, 4(196), 2015: 2167-0412.
 28. Chamorro ER, Ballerini G, Sequeira AF, Velasco GA, Zalazar MF. Chemical composition of essential oil from *Tagetes minuta* L. leaves and flowers. *The Journal of Argentine Chemical Society*, 96(1-2), 2008: 80-86.
 29. Olayiwola EA. Macro and microelements are essential to the body for the normal metabolic and proper well-being of humans. *Journal of Medinal plants Research*, 22(4), 2010: 1—5.
 30. Magdalene, O, Okputu, JI, Josephine EE. Chemical composition of natural honey obtained from Biase, Cross River, Nigeria. *Journal of Science, Engineering and Technology*, 6(1), 2019: 45-50.